ACCESSION #: 9604300164

LICENSEE EVENT REPORT (LER)

FACILITY NAME: TURKEY POINT UNIT 3 PAGE: 1 OF 6

DOCKET NUMBER: 05000250

TITLE: MANUAL REACTOR TRIP DUE TO 3C TRANSFORMER LOCKOUT AND

LOSS OF 3B STEAM GENERATOR MAIN FEEDWATER PUMP

EVENT DATE: 03/27/96 LER #: 96-006-00 REPORT DATE: 04/25/96

OTHER FACILITIES INVOLVED:

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73 (a) (2) (iv)

LICENSEE CONTACT FOR THIS LER:

NAME: O. I. Hanek, Licensing Engineer TELEPHONE: (305) 246-6607

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On March 27, 1996, Florida Power & Light Company's (FPL) Turkey Point Unit 3 was operating in Mode 1 at 100% and Unit 4 was in a refueling outage. The 4C transformer and 4C 4160 volt bus were out of service for planned maintenance.

At 1715 while performing the 4C transformer lockout trip test of 3AC01 breaker, the 3C transformer locked out resulting in a trip of the 3B steam generator feedwater pump (SGFP). Since an automatic turbine runback was not observed, a manual turbine runback was initiated and a manual reactor trip was performed due to decreasing steam generator levels. All control rods fully inserted into the core and all the rod position indication rod

bottom lights turned on after the reactor trip.

The cause of the 3C transformer lockout was mechanically induced vibration experienced after opening the 3AC01 breaker which resulted in inadvertent actuation of the GE Model 12SAM11B21A (SAM) timer relay. The failure to obtain the expected automatic turbine runback was due to a closed root valve to pressure switch PS-31604-1 which senses first stage turbine pressure, which prevented the initiation of the automatic turbine runback.

The NRC Operations Center was notified at 1816 on March 27, 1996 in accordance with 10 CFR 50.72(b)(2)(ii), Reactor Protection System Actuation and Engineered Safety Feature Actuation.

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I. DESCRIPTION OF THE EVENT

On March 27, 1996, FPL's Turkey Point Unit 3 was operating in Mode 1 at 100% and Unit 4 was in a refueling outage. The 4C transformer and 4C 4160 volt bus [EA:BU] were out of service for planned maintenance. Turkey Point Unit 4 was performing the 4C transformer lockout [EA:86] trip test of 3AC01 breaker [EA:BKR]. The supply breaker (3AC01) from the 4C transformer [EA:XFMR] to the 3C 4160 volt bus was out of its assigned cubicle with an umbilical cord connected for test operation and was situated approximately one foot from the SAM timer relay [EA:21. The trip and close fuses [EI:FU] for 3AC01 were installed. The 3C 4160 volt bus was being supplied from the 3C transformer using breaker 3AC16. In the cable spreading room, the 4C transformer lockout relay was tripped with the test blades open. The blade was closed to test the lockout trip of 3AC01. At 1745, when breaker 3AC01 opened, mechanically induced vibration resulted in inadvertent actuation of the SAM timer relay. The 3C transformer lockout actuated, and the normal bus supply breaker 3AC16

opened to deenergize the 3C 4160 volt bus, which is the normal power supply for the 3B steam generator feedwater pump (SGFP) [SJ:P]. Therefore, this caused a loss of the 3B SGFP. The plant did not run back to 60% as expected. Since an automatic turbine runback was not observed, a manual turbine runback was initiated. A manual reactor trip was performed 59 seconds into the event due to decreasing steam generator levels. The Auxiliary Feedwater System (AFW) [BA] automatically actuated on steam generator Low-Low level. All control rods fully inserted into the core and all the rod position indication rod bottom lights turned on after the reactor trip.

Unit 3 was stabilized in Mode 3 (Hot Standby) with decay heat being exhausted to the main condenser. Unit 3 was returned to service on March 29, 1996.

II. CAUSE OF THE EVENT

Root Cause Investigation

The C buses are non-safety related buses. Normally, the 4C transformer feeds the 4160 volt 4C bus through breaker 4AC16. The 4C transformer is the alternate supply to the 3C bus through breaker 3AC01. The 3C transformer is similarly configured, normally supplying the 3C 4160 volt 3C bus through breaker 3AC16. The 3C transformer is the alternate supply to the 4C 4160 volt bus through breaker 4AC01.

The 4C transformer and 4C 4160 volt bus were out of service for planned maintenance. Turkey Point Unit 4 was performing the 4C transformer

lockout trip test of 3AC01 breaker. The supply breaker (3AC01) from the 4C transformer to the 3C 4160 volt bus was out of its assigned cubicle with an umbilical cord connected for test operation. During this test configuration, the supply breaker 3AC01 was situated in the walkway of the switchgear room diagonally in front of cubicles 3AC15 and 3AC16. The SAM timer relay is mounted on the door of cubicle 3AC15. The 3AC01 breaker was situated approximately one foot from the SAM timer relay. When breaker 3AC01 opened in response to the 4C transformer lockout trip test, a subsequent 3C transformer lockout was actuated, and the normal bus supply breaker 3AC16 opened to deenergize the 3C 4160 volt bus.

There are seven control paths that will lead to the 3C transformer lockout:

1-3. 3 Bus transformer differential relays 187/3CBT (one per phase)

4. 3C transformer feeder fault relay 3AC16/3CBTX-FT (SAM timer relay)

5. Transformer fault pressure relay 3C260/163X-SFP

6. Transformer ground fault relay 64/3CBT

7. 4C bus breaker failure relay 4AC01/3CBTY-FT

Of these seven trip paths that could have led to a transformer lockout, only the 3CBX-FT (SAM timer relay) in the 3AC15 cubicle had a target after the lockout occurred.

In order for this relay to electrically actuate, both the overcurrent fault protection relay 3AC16/150-3CBTX relay and the ground fault relay

3AC16/3CBTX-GF relay must actuate. The ground fault relay can only electrically actuate in two scenarios: either the overcurrent relays for 3AC16 must actuate or the blocking diode, 3AC16/97, must fail. Since there were no targets observed after the trip on the overcurrent relays and the current at the time of the trip was about 1000 amps (3200 amps required for trip), the overcurrent relays did not actuate. In order for the ground fault relay to electrically actuate, the diode must have failed. However, failure of the diode in itself is not sufficient to cause the ground fault relay to actuate. In addition, the overcurrent fault protection relay (150-3CBTX) must also actuate, either electrically or by vibration. This relay also had no targets after the trip. Since there were no targets indicating that the overcurrent fault protection relay or the ground fault relay actuated, either electrically or by vibration, this scenario was eliminated.

A similar scenario was investigated which would allow electrical actuation of the 3CBTX-FT relay if both the overcurrent fault protection relay and the ground fault relay are mechanically actuated simultaneously due to vibration. Since these relays are mounted in cubicles 3AC16 and 3AC15 respectively, actuation by vibration is plausible. However, since no target was found on the overcurrent fault protection relay after the trip occurred, this scenario was eliminated.

The final scenario investigated was the vibration of the 3CBTX-FT relay contacts causing the 3C transformer lockout relay (186/3CBT) to actuate.

This scenario requires no additional equipment failures to take place and leaves a target on the SAM timer (3CBTX-FT) relay. The investigation showed that the actuation of the SAM relay occurred while cycling the 3AC01 breaker near the cubicle 3AC15 door. Actuation of the SAM timer relay was also verified to occur by mechanically agitating the switchgear cubicle floor without any actuation of the 3AC01 breaker.

Root Cause

Based on the above investigation, the root cause of the event was determined to be mechanically induced vibration caused by the opening of the breaker 3AC01 which resulted in an inadvertent actuation of the 3C SAM timer relay which caused a 3C transformer lockout. The 3C transformer lockout opened the normal bus supply breaker 3AC16 which deenergized the 3C 4160 volt bus. This caused a loss of the 3B SGFP.

Contributing Causes

1. Inspection of the SAM timer relay revealed that the gap associated with the SAM timer relay contacts was 0.178 millimeters for the set of contacts in use as compared to 0.332 millimeters for an unused set of contacts. The reduced gap between the SAM timer relay contacts increased the probability of inadvertent actuation of the relay when subjected to mechanical vibrations.

2. During the course of the root cause investigation, tripping of the SAM timer relay 3CBTX/FT was replicated by agitating the floor plate

directly in front of the 3AC15 cubicle. The steel floor plates inside of the 4160 volt 3C bus enclosure were found to be loose. The four floor plates in front of the breaker cubicles 3AC01, 3AC02, 3AC15 and 3AC16 were found not to be attached at a few places to structural steel members installed below, allowing transmission of vibration through the floor.

After welding of the floor plates in front of the breaker cubicles 3AC01, 3AC02, 3AC15, and 3AC16 was completed, the agitation test was repeated and the SAM timer relay 3CBTX/FT did not trip.

Turbine Runback

An automatic turbine runback due to the loss of the 3B SGFP did not occur. The root valve to PS-3-1604-1 [SB,63] which senses first stage turbine pressure was closed, preventing operation of a relay contact which would initiate the turbine runback. A manual turbine runback was initiated by the reactor operator. An investigation was performed to determine the last time the root valve to PS-3-1604-1 was manipulated. Plant records show that the turbine runback system calibration was performed in September, 1995, during the last Unit 3 refueling outage. The system calibration documentation reflects that the root valve to PS-3-1604-1 was left in the open position.

III. ANALYSIS OF THE EVENT

The Updated Final Safety Analysis Report analysis assumes a loss of feedwater to all steam generators due to the loss of the feedwater pumps

or valve malfunction. In the March 27 event, feedwater flow was not lost completely, but was reduced to 50% of normal flow, and the expected automatic turbine runback due to loss of a feedwater pump did not occur. A manual turbine runback was initiated by the reactor operator. All steam generators were affected by the reduction in feedwater flow. In the analysis, the reactor trip is expected to occur due to a Low-Low Level in any steam generator or Steam/Feedwater Flow Mismatch Coincident with Low Level in any steam generator. In this event neither trip occurred due to operator actions which manually tripped the reactor prior to reaching the steam generator Low-Low Level setpoint or the Steam/Feedwater Flow Mismatch Coincident with Low Level setpoint in any steam generator. The analysis does not credit turbine runback as a result of the loss of a feedwater pump or valve malfunction. The analysis shows that following a loss of feedwater, AFW is capable of removing the stored and residual heat, thus preventing either overpressurization of the reactor coolant system or loss of water from the reactor core. The analysis also assumes only one AFW pump is available due to a single active failure. In this event the AFW system automatically actuated on steam generator Low-Low level and all three AFW pumps were available following the reactor trip, therefore, the plant's response was bounded by the analysis. Therefore, this event did not

compromise the health or safety of plant personnel or the general public.

This event is reportable under the requirements of 10 CFR 50.73(a)(2)(iv).

IV. CORRECTIVE ACTIONS

Short Term

1. The SAM timer relay in 3AC16 was replaced.

2. The SAM timer relay in 4AC01 was inspected and replaced.

3. The root valve to PS-3-1604-1 was opened.

4. The root valve to PS-3-1604-1 was last manipulated during pressure switch calibration in September 1995. This incident predates a similar incident in November 1995 for which corrective actions included extensive training of personnel on procedural requirements for independent verification and self-checking. The individual who performed the last system calibration was counseled.

5. A walkdown was performed of the secondary side systems for both Units 3 and 4 to verify valve positions. No other discrepancies were found.

6. A walkdown was performed of the primary side Systems for Unit 4. No other discrepancies were found.

7. Loose floor steel plates in front of the breaker cubicles 3AC01, 3AC02, 3AC15 and 3AC16 inside the 4160 volt 3C bus enclosure were secured by welding to reduce vibration transmission. The balance of the floor steel plates inside the

4160 volt 3C bus enclosure will be inspected and secured by welding as needed during the next Unit 3 refueling outage.

8. All floor steel plates inside the 4160 volt 4C bus enclosure were inspected and secured by welding as needed to reduce vibration transmission.

9. Additional administrative controls for work in the C 4160 volt buses for both units were established to reduce the probability of vibration induced actuations.

10. The Unit 3 SAM timer relay wiring was modified to a double contact configuration to minimize susceptibility to vibration induced actuation.

Long Term

1. FPL will determine if any other modifications are needed to improve the 3/4 C bus reliability.

V. ADDITIONAL INFORMATION

A. Similar Events: LER 251/94-004 discusses a similar event with the 4C bus lockout caused by the jarring of a differential relay due to an interference between a breaker cubicle door and the wall of the switchgear room.

B. EIIS Codes are shown in the format [EIIS SYSTEM: IEEE component function identifier, second component identifier (if appropriate)].

FPL

APR 25 1996

L-96-98

10 CFR section 50.73

U. S. Nuclear Regulatory Commission

Attn: Document Control Desk

Washington, D. C. 20555

Gentlemen:

Re: Turkey Point Unit 3

Docket No. 50-250

Reportable Event: 96-006-00

Manual Reactor Trip Due to 3C

Transformer Lockout and Loss of

3B Steam Generator Main Feedwater pump

The attached Licensee Event Report, 250/96-006-00, is being provided in accordance with 10 CFR 50.73(a)(2)(iv).

If there are any questions, please contact us.

Very truly yours,

R. J. Hovey

Vice President

Turkey Point Plant

OIH

attachment

cc: Stewart D. Ebneter, Regional Administrator, Region II,

USNRC

Thomas P. Johnson, Senior Resident Inspector, USNRC,

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